

Remarks:

Reconsideration of the application is requested.

Claims 1-6 remain in the application. Claims 1 and 5-6 have been amended.

Enclosed are copies of the cover pages of US Patent No. 6,469,365 and US Patent No. 3,430,110 which correspond to the references DE 198 05 786 and DE 1 564 547, respectively, cited in the filed IDS. No other English language publication corresponding to any one of the other cited DE references has been found.

In item 3 on page 2 of the above-identified Office action, claims 1 and 5-6 have been rejected as being obvious over *Yamaguchi et al.* (US 5,321,281) in view of *Burke* (US 5,793,070) under 35 U.S.C. § 103.

In item 5 on page 3 of the Office action, claims 3 and 4 have been held allowable, if rewritten or amended to include all of the limitations of the base claim and any intervening claims.

The above-noted rejection has been considered and claim 1 has been amended in an effort to even more clearly define the

invention of the instant application. Support for the changes is found on page 3, lines 3-4, of the specification.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 as amended calls for, inter alia:

a first highly doped well zone of the first conductivity type and a second highly doped well zone of a second conductivity type, opposite to the first conductivity type, successively disposed between said drift zone and said semiconductor substrate ***providing a PN insulation.***

In item 3 on page 2 of the Office action, the Examiner stated that *Yamaguchi et al.* "discloses in figure 2 ... first and second well regions 2 and 3 of different conductivity types disposed between the drift zone and the substrate." The Examiner stated that *Yamaguchi et al.* "does not disclose, in the figure, that the well regions are heavily doped and the substrate and the drift zone are lightly doped." The Examiner applied the secondary reference *Burke* for disclosing that "changing the doping of semiconductor layers changes their resistivity".

In col. 8, line 65, through col. 9, line 10, *Yamaguchi et al.* state:

... the p-type semiconductor in the top surface of the p-type base **region 3** between the n-type emitter regions 4 and n-type epitaxial layer 2 is inverted into an n-type semiconductor to **form n-type channels**. Then, **conduction** is permitted **between the n-type epitaxial layer 2** serving as a drain of an MOSFET equivalently formed in the IGBT unit cell 210 **and the n-type emitter regions 4** serving as a source thereof, and **an electronic current flows from the n-type emitter regions 4 through the n-type channels into the n-type epitaxial layer 2**. The electronic current serves as a base current for a pnp bipolar transistor equivalently formed by the p-type collector layer 1, n-type epitaxial layer 2, and p-type base region.

(emphasis added)

Clearly, *Yamaguchi et al.* do not show a PN insulation between the low-doped semiconductor substrate and the low-doped drift zone, as recited in claim 1 of the instant application.

The inventive concept of the invention of the instant application is to electrically isolate IC components by using a PN insulation formed between a low-doped semiconductor substrate and a low-doped drift zone. As discussed above, *Yamaguchi et al.* do not show a PN insulation between the low-doped semiconductor substrate and the low-doped drift zone. Therefore, the invention as recited in claims 1 and 5-6 of the instant application is believed not to be obvious over *Yamaguchi et al.* in view of *Burke*.

It is accordingly believed to be clear that *Yamaguchi et al.* in view of *Burke* do not suggest the features of claims 1 and

5-6. Claims 1 and 5-6 are, therefore, believed to be patentable over the art and because claims 2-4 are ultimately dependent on claim 1, they are believed to be patentable as well.

Considering the deficiencies of the primary reference *Yamaguchi et al.*, it is believed not to be necessary at this stage to address the secondary reference *Shekar* applied in the rejection of dependent claim 2 in item 4 on page 3 of the instant application in any greater detail, and whether or not there is sufficient suggestion or motivation with a reasonable expectation of success for modifying or combining the references as required by MPEP § 2143.

In view of the foregoing, reconsideration and allowance of claims 1-6 are solicited.

The Examiner's comments in the last paragraph in item 7 of the Office action have been considered, claims 5 and 6 have been amended and are no longer dependent on claim 1. Consequently, the recited process steps in claims 5 and 6 should now be considered.

If an extension of time is required, petition for extension is herewith made. The extension fee for response within a period

of one month pursuant to Section 1.136(a) in the amount of \$
110.00 in accordance with Section 1.17 is enclosed herewith.

Please charge any other fees which might be due with respect
to Sections 1.16 and 1.17 to the Deposit Account of Lerner and
Greenberg, P.A., No. 12-1099.

Respectfully submitted,



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Version with markings to show changes made:

Claim 1 (amended). An IGBT with PN insulation, comprising:

a low-doped semiconductor substrate of a first conductivity type;

a low-doped drift zone of the first conductivity type formed in said low-doped semiconductor substrate; and

a first highly doped well zone of the first conductivity type and a second highly doped well zone of a second conductivity type, opposite to the first conductivity type, successively disposed between said drift zone and said semiconductor substrate providing a PN insulation.

Claim 5 (amended). A method of manufacturing a well zone for [the] an IGBT [according to claim 1], which comprises manufacturing horizontal regions of [the] a well [zones] zone of an IGBT according to claim 1 by one of implantation and diffusion, and manufacturing vertical regions of the well zones by performing at least two epitaxial steps with a subsequent process selected from the group consisting of implantation and diffusion.

Claim 6 (amended). A method of manufacturing a well zone for the IGBT according to claim 1, which comprises manufacturing horizontal regions of [the] a well [zones] zone of an IGBT according to claim 1 by one of implantation and diffusion, and manufacturing vertical regions of the well zones by etching trenches and subsequently filling the trenches with doped polycrystalline silicon and diffusing out.